IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: N. Toyama et al.	: Art Unit:
Serial No.: To Be Assigned	: Examiner:
Filed: Herewith	:
FOR: VIDEO MIXING APPARATUS AND	:
METHOD OF MIXING VIDEO	:

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

S I R :

Prior to examination, please amend the above-identified application as follows:

IN THE SPECIFICATION:

Please replace the following paragraphs:

At page 3, line 5:

In the structure shown in Fig. 15, mixing processor 1103 outputs mixed video signal Vm according to the following formulas (4):

At page 4, line 26:

Basically, in a pixel at which the key signal generator outputs key signal K=0, mixed video signal Vm - background video signal Vz should be satisfied. In other words, regarding a luminance component, the term of Sy – (1 – K)Ry in (4a) should take "0" (zero) and My = Zy should be satisfied. However, since the screen has some noises, Sy ≠ Ry, thus error of Sy – Ry appears in the mixed video.

At page 5, line 17:

The video mixing apparatus of the present invention comprises a key signal generator and a screen signal generator. The key signal generator generates a key signal based on a position of a source video signal in a key signal distribution formed by two ovals set in the three-dimensional space.

At page 5, lines 21-22:

The key signal generator sets an oval body in key signal distribution in the three-dimensional space including the luminance component. Further, the key signal generator generates a key signal based on a position of a source video signal in the key signal distribution. Thus, the key signal generator can separate properly the foreground object from the screen.

At page 6, lines 12-14:

Fig. 6 shows an example of cross sections; cross sections of distribution of pixels constituting a screen and a foreground object respectively, and a cross section of a boundary face specifying distribution of key signals generated by a key signal generator in accordance with the first exemplary embodiment of the present invention.

At page 7, line 12:

Fig. 17 is an example of a source video signal.

At page 7, lines 15-17:

Fig. 19 shows an example of cross sections; cross sections of distribution of pixels constituting a screen and a foreground object respectively, and a cross section of a boundary face specifying distribution of a key signal generated by the conventional key signal generator.

At page 9, lines 10-12:

As shown in Fig. 3B, "d" calculated by formula (6) represents a length of a shorted axis of an oval body which passes through Vs and has a center Vr shown in Fig. 3B, and satisfies the following formula:

At page 10, line 6:

Here is one example showing the production of a key signal from a source video shown in Fig. 4. Fig. 5 shows respective pixels-constituting the source video shown in Fig. 4-projected on a plane vertical to a color difference component plane. In Fig. 5, the pixels constituting the foreground object are distributed in the vicinity of region F 501, while the pixels constituting the screen are distributed in the vicinity of region X 502. Between these two regions, the pixels constituting the edge of foreground object are distributed, and the pixels are mixed with both the components of foreground object and the screen. In this case, if oval bodies E0 and E1 shown in Fig. 3A are used, boundary faces c 603 and d 604 can be set, so that region F 501 and region X 502 are properly separated. Meanwhile, boundary face c 603 is an oval body surrounding region F 501, and boundary face d 604 is an oval body surrounding boundary face c 603.

At page 10, line 15:

As such, the video mixing apparatus in accordance with this embodiment can set a boundary with a plane of an oval body, so that a key signal-properly separating a component of foreground object from a screen component-can be generated. As a result, a mixed video without lowering video quality can be supplied.

At page 12, line 19:

Parameters "Ar", "Aw" and "t" are set by a user, and $Ar > 0$, $Aw > 0$, $t > 0$.

At page 12, lines 20-22:

In other words, as shown in Fig. 9A, when source video signal Vs is inside first oval body E0 and the key signal generator outputs a key signal so that K = 0 is satisfied, screen signal generator 803 outputs source video signal Vs as it is.

At page 12, lines 24-25:

As shown in Fig. 9B, when source video signal Vs is outside oval E0 and the key signal generator outputs a key signal so that K >0 is satisfied, screen signal generator 803 outputs a coordinates value of point "c" as screen signal Vx, where point "c" is a cross point of vector VrVs 62 starting from screen reference color Vr toward source video signal Vs and oval body E0.

At page 13, line 13:

In this embodiment, the key signal distribution is formed by two oval bodies which share a common center Vr and also have the same ratio of shorter axis length vs. longer axis length. It is not limited to these oval bodies, but the key signal distribution can be formed by another two oval bodies having different centers and different ratios of shorter axis length vs. longer axis length. In this case, Vx = Vs is supplied to source video signal Vs which receives key signal K (K = 0), while a coordinates value of the cross point of vector VrVs starting from Vr toward Vs and oval body E0 is supplied as screen signal Vx to source video signal Vs which receives key signal K (K > 0).

At page 14, line 12:

Key signal generator 1001 outputs color-canceling key signal Kc and mixing key signal Km following formulas (14) – (16).

IN THE CLAIMS:

Please replace claims 1, 7 and 8 with the following:

1. A video mixing apparatus taking out a foreground object component from a source video signal obtained by shooting an object in front of a

monochromatic screen, and fitting the object component into a background video signal, said apparatus comprising:

a key signal generator for setting a key signal distribution formed by a first oval body surrounding a reference color of the screen in a three-dimensional color space and a second oval body surrounding the first oval body, and for generating a mixing key signal according to positional a relation among the source video signal, the first oval body and the second oval body in the key signal distribution; and

a mixing processor for taking out the foreground object component by the mixing key signal, and for mixing the object component with the background signal.

7. A method of mixing videos by taking out a foreground object component from a source video signal obtained by shooting an object in front of a monochromatic screen, and fitting the object component into a background video signal, said method comprising the steps of:

(a) setting a first oval body, surrounding a reference color of the screen, in a three-dimensional color space;

(b) setting a key signal distribution formed by a second oval body surrounding the first oval body and the first oval body;

(c) generating a mixing key signal based on a positional relation among the first oval body, the second oval body and the source video signal in the key signal distribution;

(d) taking out the foreground object component by the mixing key signal; and

(e) mixing the object component with the background signal.

8. The method of mixing videos of Claim 7, wherein step (c) includes the steps of:

(c-1) setting a distance as a base clip level, where the distance spans between the reference color and a cross point of the first oval body and a vector starting from the reference color toward the source video signal;

(c-2) setting a distance as a peak clip level, where the distance spans between the reference color and a cross point of the second oval body and a vector starting from the reference color toward the source video signal; and

(c-3) setting a value responsive to a distance between the source video signal and the reference color as the mixing key signal, where the value is saturated at the base clip level and the peak clip level with respect to the distance.

Respectfully Submitted,

Lawrence E. Ashery, Reg. No. 34,515
Attorney for Applicants

LEA/ap
Dated: May 8, 2001

Suite 301
One Westlakes, Berwyn
P.O. Box 980
Valley Forge, PA 19482-0980
(610) 407-0700

The Assistant Commissioner for Patents is hereby authorized to charge payment to Deposit Account No. **18-0350** of any fees associated with this communication.

EXPRESS MAIL Mailing Label Number:EL835693560US
Date of Deposit: May 8, 2001

I hereby certify that this paper and fee are being deposited, under 37 C.F.R. § 1.10 and with sufficient postage, using the "Express Mail Post Office to Addressee" service of the United States Postal Service on the date indicated above and that the deposit is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

Kathleen Libby

VERSION WITH MARKINGS SHOWING CHANGES MADE

SPECIFICATION:

At page 3, line 5:

In the structure shown in Fig. [14] 15, mixing processor 1103 outputs mixed video signal Vm according to the following formulas (4):

At page 4, line 26:

[Basically, a pixel-receiving key signal K=0 at the key signal generator -is to be mixed video signal Vm = background video signal Vz.] Basically, in a pixel at which the key signal generator outputs key signal K=0, mixed video signal Vm - background video signal Vz should be satisfied. In other words, regarding a luminance component, the term of Sy – (1 – K)Ry in (4a) should take "0" (zero) and My = Zy should be satisfied. However, since the screen has some noises, Sy ≠ Ry, thus error of Sy – Ry appears in the mixed video.

At page 5, line 17:

The video mixing apparatus of the present invention comprises a key signal generator and a screen signal generator. The key signal generator generates a key signal based on a position of a [screen reference color] source video signal in a key signal distribution formed by two ovals set in the three-dimensional space.

At page 5, lines 21-22:

The key signal generator sets an oval body in key signal distribution in the three-dimensional space including the luminance component. Further, the key signal generator generates a key signal based on a position of a [screen reference color] source video signal in the key signal distribution. Thus, the key signal generator can separate properly the foreground object from the screen.

At page 6, lines 12-14:

[Fig. 6 shows a boundary face specifying distribution of key signals generated by a key signal generator and a cross section of pixels constituting a screen.] Fig. 6 shows an example of cross sections; cross sections of distribution of pixels constituting a screen and a foreground object respectively, and a cross section of a boundary face specifying distribution of key signals generated by a key signal generator in accordance with the first exemplary embodiment of the present invention.

At page 7, line 12:

Fig. 17 is an example of a source video signal.

At page 7, lines 15-17:

[Fig. 19 is a cross section of respective pixels constituting a screen, a foreground object and a boundary face, these three specify a distribution of a key signal generated by the conventional key signal generator.] Fig. 19 shows an example of cross sections; cross sections of distribution of pixels constituting a screen and a foreground object respectively, and a cross section of a boundary face specifying distribution of a key signal generated by the conventional key signal generator.

At page 9, lines 10-12:

As shown in Fig. 3B, ["d1" calculated by formula (6) passes through Vs and represents a length of a shorter axis of an oval body which has a center Vr shown in Fig. 3B and satisfies the following formula:] "d" calculated by formula (6) represents a length of a shorted axis of an oval body which passes through Vs and has a center Vr shown in Fig. 3B, and satisfies the following formula:

At page 10, line 6:

Here is one example showing the production of a key signal from a source video shown in Fig. 4. Fig. 5 shows respective pixels-constituting the source video shown in Fig. 4-projected on a plane vertical to a color difference

component plane. In Fig. 5, the pixels constituting the foreground object are distributed in the vicinity of region F 501, while the pixels constituting the screen are distributed in the vicinity of region X 502. Between these two regions, the pixels constituting the edge of foreground object are distributed, and the pixels are mixed with both the components of foreground object and the screen. In this case, if oval bodies E0 and E1 shown in Fig. 3A are used, boundary faces c 603 and d 604 can be set, so that region F 501 and region X 502 are properly separated. Meanwhile, boundary face c 603 is an oval body surrounding region F 501, and boundary face d 604 is an oval body surrounding boundary face c 603.

At page 10, line 15:

As such, the video mixing apparatus in accordance with this embodiment can set a boundary with a plane of an oval body, so that a key signal-properly separating a component of foreground object from a screen component-can be generated. As a result, a mixed video without lowering video quality can be supplied.

At page 12, line 19:

Parameters "Ar", "Aw" and "t" are set by a user, and Ar > 0, Aw > 0, [T] t > 0.

At page 12, lines 20-22:

In other words, as shown in Fig. 9A, [when key signal K is output so that source video signal Vs is inside first oval body E0 and K = 0 is satisfied in the key signal generator,] when source video signal Vs is inside first oval body E0 and the key signal generator outputs a key signal so that K = 0 is satisfied, screen signal generator 803 outputs source video signal Vs as it is.

At page 12, lines 24-25:

As shown in Fig. 9B, [when a key signal is supplied so that source video signal Vs is outside oval E0 and K > 0 is satisfied in the key signal generator] when source video signal Vs is outside oval E0 and the key signal

generator outputs a key signal so that K >0 is satisfied, screen signal generator 803 outputs a coordinates value of point "c" as screen signal Vx, where point "c" is a cross point of vector VrVs 62 starting from screen reference color Vr toward source video signal Vs and oval body E0.

At page 13, line 13:

In this embodiment, the key signal distribution is formed by two oval bodies which share a common center Vr and also have [the same a ratio (t) of] the same ratio of shorter axis length vs. longer axis length. It is not limited to these oval bodies, but the key signal distribution can be formed by another two oval bodies having different centers and different ratios of shorter axis length vs. longer axis length. In this case, Vx = Vs is supplied to source video signal Vs which receives key signal K (K = 0), while a coordinates value of the cross point of vector VrVs starting from Vr toward Vs and oval body E0 is supplied as screen signal Vx to source video signal Vs which receives key signal K (K > 0).

At page 14, line 12:

Key signal generator 1001 outputs color-canceling key signal [Kx] Kc and mixing key signal Km following formulas (14) – (16).

CLAIMS:

1. A video mixing apparatus taking out a foreground object component from a source video signal obtained by shooting an object in front of a monochromatic screen, and fitting the object component into a background video signal, said apparatus comprising:

a key signal generator for setting a key signal distribution formed by a first oval body [surrounding a region where a reference color of the screen is distributed] surrounding a reference color of the screen in a three-dimensional color space and a second oval body surrounding the first oval body, and for generating a mixing key signal according to positional a relation among the source video signal, the first oval body and the second oval body in the key signal distribution; and

a mixing processor for taking out the foreground object component by the mixing key signal, and for mixing the object component with the background signal.

7. A method of mixing videos by taking out a foreground object component from a source video signal obtained by shooting an object in front of a monochromatic screen, and fitting the object component into a background video signal, said method comprising the steps of:

(a) setting a first oval body, [surrounding a region where a reference color of the screen is distributed] surrounding a reference color of the screen, in a three-dimensional color space;

(b) setting a key signal distribution formed by a second oval body surrounding the first oval body and the first oval body;

(c) generating a mixing key signal based on a positional relation among the first oval body, the second oval body and the source video signal in the key signal distribution;

(d) taking out the foreground object component by the mixing key signal; and

(e) mixing the object component with the background signal.

8. The method of mixing videos of Claim 7, wherein step (c) includes the steps of:

(c-1) setting a distance as a base clip level, where the distance spans between the reference color and a cross point of the first oval body and a vector starting from the reference color toward the source video signal;

[(c-2) setting a distance as a base clip level,] (c-2) setting a distance as a peak clip level, where the distance spans between the reference color and a cross point of the second oval body and a vector starting from the reference color toward the source video signal; and

(c-3) setting a value responsive to a distance between the source video signal and the reference color as the mixing key signal, where the value is saturated at the base clip level and the peak clip level with respect to the distance.